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Evaluate Quantity Take-off for CADD-COST Software Integration

Final Report

By Cost Field Activities CADD Group
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Executive Summary

The Cost Engineering function within the Corps of Engineers has undergone significant downsizing in the past few years and the implementation of CADD and electronic bid sets (EBS) has created a situation where Cost Engineering must adopt a different business paradigm. Cost estimators toiling over paper drawings with marking pens and rulers must replace these tools and methods with computer technology. Virtual office concepts will necessitate electronic sharing of data, in particular, on-screen quantity take-offs.

To address manpower and technology changes, the over-arching goal is to Integrate Cost Engineering and Computer Aided Design and Drafting (CADD) to provide tools that will enable cost engineers to work in the CADD environment to identify material / quantity take-off and populate databases portable to estimating software.

The purpose of this report is to identify and recommend electronic quantity take-off technology for the Corps of Engineers. This report is prepared by the Cost Engineering Field Action CADD Group (CFAC). CFAC is comprised of Cost Engineers and Estimators whose purpose is to enhance all Corps Districts' CADD usage. The CFAC is under the direction of the Senior Advisory CADD Group, which is comprised of Engineering Division Chiefs providing leadership and vision for the Corps' CADD program.

Consistency and uniformity throughout the Cost Engineering function, particularly the Microcomputer Aided Cost Estimating System (MCACES), is directed by ER 1110-2-1302, Civil Works Cost Engineering. In addition, through the Tri-Service Automated Cost Engineering System (TRACES) uniformity and consistency makes possible virtual project delivery teams across the nation.

There is a desire to maintain similar consistency throughout the Corps in regards to quantity take-off. However, quantity take-off is not a part of upward reporting, and neither is the process nor specific software for quantity take-off identified in regulations. Because Corps Districts conduct a variety of work, quantity take-off processes for each can be drastically different.

Three commercially available quantity take-off products are recommended. Each meets the goal to enable cost engineers to work in the electronic drawing environment. Each software has the ability to populate or export to a spreadsheet format. Currently spreadsheets appear to be the most widely used format prior to inserting quantity data into estimating programs. The following are recommended for Cost Engineering application.

On-Screen Takeoff, OnCenter Software, Inc.
BidScreen XL, Vertigraph Inc.
MaxTakeoff, MaxView Corporation

Cost Engineering offices or individual estimators that already use extensive Excel spreadsheets for quantity take-off will find BidScreen XL the most applicable to their existing take-off processes.

It is recommended that Cost Engineering offices currently without a defined quantity take-off system consider On-Screen Takeoff or MaxTakeoff as a tool to implement electronic drawing take-off.

An initial list of CADD and cost related technologies was assembled based on individual knowledge and experience and from information gathered at technology seminars and industry conferences. This list was reduced to only those quantity take-off technologies that utilize microcomputers and view design plans on-screen. Evaluations are based on information contained in product sales literature, information from the product's respective Internet web page, and demonstration software. Evaluations were limited to software that specifically tabulated quantity take-off, were commercially available no later than September 2001, and utilized electronic drawings. Digitizing from paper drawings was not considered. Specific criteria were developed for evaluation and the value engineering process was used to rank the evaluated software products. Evaluating software products against specific criteria can be very subjective. However, applying value engineering processes result in a quantitative evaluation of each program against the criteria.

Due to the physical restraints of time and funding, the assembled list of technologies and their reviews should not be considered a fully definitive all encompassing list of technologies for these purposes.

Future challenges for the CFAC are to promote and encourage implementation of electronic quantity take-off throughout the Corps Cost Engineering offices.

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1 – Introduction

The Cost Engineering function within the Corps of Engineers has undergone significant downsizing in the past few years and the trend is continuing. This, added to the fact that we have 41 District offices, has created a situation where we need to adopt a different business paradigm. The paradigm "move people to where the work is" is now changing to "move work where people are." This is called "collaborative engineering" or the "virtual office" concept.

The goal is to Integrate Cost Engineering and Computer Aided Design and Drafting (CADD) to provide tools that will enable cost engineers to work in the CADD environment to identify material / quantity take-off and populate databases portable to estimating software.

Quantity take-off is the first important phase of each cost estimate. It must be as accurate as possible, and should be based on all available engineering and design data. Quantity take-off may be developed by design offices or by contracted Architect Engineer and then provided to the Cost Engineer; however, the responsibility for the accuracy of the quantities in the estimate remains with the Cost Engineer.

The Cost Engineer must thoroughly understand the project scope of work, review drawings, specifications and review all pertinent documents to determine construction activities and in particular, construction crew production. In effect, the Cost Engineer must thoroughly know the project. Quantity take-off is one of the most effective means for the cost estimator to become fully aware of all design and construction aspects of the project and especially any nuances that may affect costs.

The object of this report is to evaluate technologies (software) that will assist the Cost Estimator, improve take-off accuracy, and automate quantity take-off tasks.

The Cost Engineering Field Action CADD Group (CFAC) is comprised of Cost Engineers and Estimators whose purpose is to enhance all Corps District's CADD usage through the dissemination of information, sharing of resources and collaborative efforts as necessary. This report is the initial efforts of this group to fulfill its purpose.

New technology and the CADD future is object oriented where building or structure elements have "intelligence;" the elements "know" what they are and what they do. A wall knows its length, height, surface area, construction, etc. During design, objects are assembled into a building model (drawn in 3-D CADD), and when changes are made, i.e. a door or window is removed or moved, the system will automatically adjust the CADD representation of the structure and related quantities and measurements. The information stored in the object database can be linked to cost estimating software to generate required cost estimates. Evaluation of these systems is beyond the scope of evaluations in this report.

Evaluations are limited to those technologies that specifically tabulate quantities that are selected by the estimator or quantity take-off person. Only commercially available technologies utilizing electronic drawings (drawings viewed on a monitor) are considered. Digitizing from paper drawings is not considered. The systematic approach of value engineering analysis is used to evaluate the technologies that meet these two primary criteria.

2 – Methodology

An initial list of CADD and cost related technologies was assembled based on individual knowledge and experience and from information gathered at technology seminars and industry conferences. The team categorized this initial list into five groups of technologies.

1. Computer Aided Design and Drafting (CADD), software and programs specifically used to design, draft, and produce drawings.
2. Quantity Take-off software and programs, which identify and quantify elements of the design drawings.
3. Data Management technologies and programs, which can manage physical data and cost data to facilitate estimate preparations.
4. Integrated CADD – Cost: These are typically three-dimensional (3D) CADD programs that export quantities directly to a cost-estimating program. As the design changes the cost estimate changes also.
5. Cost Estimating software and programs specifically used to prepare a cost estimate.

Evaluations in this report are limited to those technologies that fall into group 2, quantity take-off. Additional Internet searches were done and several more quantity take-off software products were added to the list for evaluation. Evaluations were further reduced to only software products that utilize microcomputers and view design plans on-screen. Software not currently available on the commercial market as of September 2001, are not included in the evaluations. Information gathering and evaluations were conducted both as a team and individually.

The team met to determine evaluation criteria and to assign weighting values to each criterion. This process culminated in assigning a weight value to each criterion as compared individually with all other criterion. The second step of the analysis is to evaluate how each product meets each criterion. A number value is assigned based on how well the software meets the criterion. This number value is then multiplied times the weight number of the criterion to compute each criterion score. The summation is the total score for the product. Total scores are used to rank the products. The analysis follows a value engineering process.

3. – Evaluations

Evaluations are based on descriptive information from each product sales literature and information from the product's respective Internet web page. Where possible, demonstration software was provided or downloaded from the Internet for evaluation. Both Pro and Con opinions do not constitute an official endorsement or approval of the use of the commercial product. Each writer has attempted to evaluate the take-off programs from a Corps of Engineer's Cost Engineering perspective.

Each evaluation includes a description of the product, how the product meets the evaluation criteria, both pro and con, and a brief evaluation synopsis.

Materials 2000

368 Earhart Way,
Livermore, CA 94550

www.agtek.com Phone (800) 441-1140
Regional Sales representative Phone (503) 452-9106

Materials 2000 quoted price at $4,500.00 (August 2001).

DESCRIPTION

Combining powerful zoom and snap features, intuitive CADD interface and vast data capacity, “Materials 2000” accelerates your measurement of complex lengths, areas, and counts from CADD files, Sitework 98 or paper plans. Electronic plan formats include CADD (DXF) or Sitework 98. If no electronic formats are available, manual digitizing from paper plans is compatible.

Material / quantity take-off templates can be user-created for material, structure and phase of work. Its conversion database readily extends your measurements into yards, tons, lineal feet, etc., and reports your quantities to a predefined report format. Materials 2000 allows for exports to Excel, and ASCII file formats, and prints comprehensive graphical documentation through any Windows compatible color printer. Materials-2000 allows the user to work within a CADD type environment and utilize color and/or symbolic annotations to represent different phases of the quantity take-off information. All annotations are tagged for easy recognition.

Materials 2000 is relatively simple to learn. With the purchase of the software, you receive a one-half day of on-site training, a user manual, and a technical reference.

PRO

- Works with CADD (DXF) file formats (vector format).
- Allows for an audit trail.
- Allows for a user-created template design.

CON

- No raster formats supported (tiff format).
- No layering capability is available in the software.
- This software requires an intermediate step to get your quantity information to a spreadsheet format.
- A non-proprietary image viewer is not available with this software.

SYNOPSIS

The intuitive CADD interface is the most desirable feature of this product. It allows for exact three-dimensional measurements based on the CADD designed elements. If no CADD designs are available, it allows for manual digitizing from paper-plans. No raster formats (tiff, jpg, etc…) are supported in this software.

Through discussion with company representatives and literature the software appears to be relatively simple to learn. The general users of this software are disciplines related to estimating, surveying, excavating, grading, and paving. No demo version of the software was available for review.

AGTEK Materials 2000 meets the goal to enable cost engineers to work in the electronic drawing environment to identify material / quantity take-off portable to estimating related software.

MS Power Scope

Bentley Systems, Incorporated
19752 MacArthur Blvd., Suite 220
Irvine, CA 92715

www.bentley.com/products/powerscope Tel (949) 474-1290

MS Power Scope GSA quoted price at $187.50 (August 2001).

DESCRIPTION

Through MicroStation PowerScope v7.1, project team members have the ability to securely view and mark up the engineering data without making any changes to the original design. MicroStation PowerScope v7.1 directly reads MicroStation 2D & 3D DGN CADD files with 100% graphical fidelity and supports Windows Systems Printing abilities. PowerScope v7.1 also reads DWG and DXF file formats.

MicroStation PowerScope v7.1 utilizes many powerful MicroStation features, including AccuDraw® and SmartLine®. AccuDraw technology is designed to make redlining easy by positioning and orienting any object easily and precisely—in 2D or 3D. SmartLine is a composite drawing tool that is especially useful when redlining because it lets you use a single tool to create various types of markups. When you activate the SmartLine tool and begin creating geometry, it understands the most efficient method to store redline data based on your input. PowerSelector and Level Manager, similarly enhance the redlining process. PowerSelector enables you to quickly create simple or complex selection sets for things like measurement information. The Level Manager tool provides a single dialog box from which you can determine which levels are displayed, which levels contain information, and which level names are currently being used. It enhances engineering project coordination and minimizes data redundancy by letting you simultaneously view and manipulate multiple vector-based design files as well as binary and continuous tone raster files as reference files. Engineering Links tools enable you to attach links from your redline data to related designs.

PRO

- Primarily a redlining tool to provide design review analysis and comments.
- Raster formats are supported through CADD related file-referencing capabilities.
- The software allows for auditing through a level manager tool to determine which levels are displayed, which levels contain information, and which level names are currently being used. It allows for various types of markups through symbology differences.
- Links tools enable you to link from the redline data to related design data. The user can embed views from within MicroStation PowerScope into compound documents in other Windows applications, and reactivate PowerScope from within Microsoft Word or Excel by clicking on the embedded object.

CON

- Raster formats are supported through CADD related file referencing capabilities no separate viewers are available.
- No template design capability exists.
- The user is required to use OLE Automation Server (Object embedding) abilities in order to export data to a Microsoft Word or Excel format.

SYNOPSIS

MicroStation PowerScope v7.1 is primarily a design review solution, which lets you view designs, as well as analyze design data and openly communicates revision changes.

No demo version was available for review. Through review of literature, the software appears to be more difficult to learn. Although, the user interface is consistent with many other contemporary Windows applications, the software requires the user to be familiar with the related CADD interface, design capabilities, and project file naming conventions.

MicroStation PowerScope does not meet the goal to enable cost engineers to work in the electronic drawing environment to identify material/quantity take-off portable to estimating related software.

Quantity Take-off Modules

EAGLE POINT
4131 Westmark Drive
Dubuque, IA 52002

Demos are available at www.eaglepoint.com

DESCRIPTION

Eagle Point Software offers a vast array of software products that can assist the Cost Engineer in developing quantity takeoffs from electronic drawings. Eagle Point Software Company has over 160 products in stock that support the engineering design and contractor community, There are eight separate software divisions that support a line of products that cover civil engineering; surveying; hydraulics and hydrology, architectural, landscape design, construction, structural and presentation software.
Eagle Point's SolidBuilder series includes three modules that can run independently. SolidBuilder is for designers, builders and estimators. It builds a 3D computer model of the building and takes you through each step of the design, generating take-off and production information at the touch of a key. The integrated program allows you and your customers to see what you will build before construction and enables you to create precise detailed plans. EZ-Builder is an inexpensive tool for beginners and novice software users with less sophisticated needs. If you only want to estimate, then Bid-builder is the software tool to use. Bid-builder and Solidbuilder are 100 percent compatible. Bid-builder is the cost estimating module for estimators, contractors and subcontractors. Simple takeoff for specific applications such as drywall, paint, tile or carpet quantities can be done using the Bid-Builder estimating software. It allows for simple quick takeoffs for these singular items and provides capability to generate numerous reports. A complete quantity takeoff for larger building projects can be done simply and easily.

The following design products also feature a quantity takeoff

- **Architecture**

  Eagle Point's architectural software can be used to create finished designs used in conjunction with CADD software packages. Once the exterior of the structure is finished, the designer can move on to the interior to create ductwork and piping. Upon design completion, you can create a bill of materials report for use in preparation of cost estimates.

  Major Software Products

  ArchT - $595.00
  DetailPro - $295.00
  HVACPro - $295.00

PipePro - $295.00
Quantity Takeoff - $195.00

- **Building Design & Estimating**

The building design and estimating products allow you to produce two and three dimensional computer models of a building, then provides the capability to take you through each step of the design, generating take-offs and production information with minimal effort. Once the building is complete, you can generate a complete estimate for the project.

Major Software Products

SolidBuilder - $2795.00
EZ Builder - $495.00
BidBuilder – Varies see below

The Cost Engineer or estimator may choose from five separate modules for BidBuilder software, depending on their needs, specifically

BidBuilder Basic - Price $795.00
BidBuilder Intermediate - Price $1,995.00
BidBuilder Advanced - Price $2,995.00
BidBuilder Bid Control - Price $995.00
BidBuilder Takeoff - Price $995.00

- **Civil Design**

A complete line of civil design products lets you quickly and easily design your site from building pads and surface models to road and intersection design.

Major Software Products

Intersection Design - $600.00
Profiles - $300.00
Quantity Takeoff - $300.00
RoadCalc - $1200.00
Site Design - $600.00
Surface Modeling - $600.00

- **Hydraulics & Hydrology**

A complete line of hydraulics and hydrology products lets you design both single drainage lines to complete complex systems. Material quantities can be quickly

derived from the design with the use of a quantity take off software that supports the design software package.

Major Software Products

Sanitary Sewers - $600.00
Storm Sewers - $600.00
Quantity Takeoff - $600.00
Water Surface Profiling - $600.00
Watershed Modeling - $600.00

- **Surveying**

The surveying product line allows you work closely with the field crew to collect important field data that you can quickly and easily download for use in your designs. A quantity takeoff software package can be used in conjunction with surveying software to dramatically reduce the amount of time counting items and measuring lengths on a drawing to provide more time to analyze design alternatives. The ability is provided to assign ID tags to assist with material takeoff. The quantity takeoff software is integrated with other modules to report tabulation of materials, unit costs for specific items, labor costs, and total costs of an entire project.

Major Software Products

Data Collection - $300.00
COGO - $300.00
Data Transfer - $300.00
Drafting - $300.00
Quantity Takeoff - $300.00
Surface Modeling - $300.00
Survey Adjustment - $300.00

PRO

- Method of training is flexible allowing for video based, computer based and Classroom training or any combination required.
- Compatible with Windows Operating Systems 95/98/NT.
- Custom software programming can be provided if warranted.
- Service is available to provide for building of custom databases.
- Capability to use CADD files (.dwg) for scaling was demonstrated.

CON

- Several separate software packages may be required to do a complete quantity takeoff for a given project.
- The ability to provide an audit trail providing the ability to check, redline, provide layer on/off was not evident from software demonstrations.
- The ability to export to other spreadsheet databases such as lotus and excel was not evident.
- For Bid-Builder alone, several separate software packages from basic to advanced versions make it difficult to choose appropriate software for office use.
- The software cannot read raster (.tif, .jpg, .cal) drawing file formats.
- Capability of takeoff software for use at drawing levels was not demonstrated
- Use of takeoff software appeared difficult for a new user
- Software did not appear to lend itself to 3rd party modification

SYNOPSIS

Several design software packages are available. . Design packages include architecture, building design, civil design, hydraulics and hydrology as well as surveying. Each design package has an associated quantity takeoff module that is used for a specific purpose the estimator can work by using individual design disciplines and is not required to do takeoff on an entire project at one time. Work can be split up by individual discipline or design component.

Electronic drawing quantity take-off is complicated by the necessity to use multiple Eagle Point design software to produce quantities and further complicated in that each design must be created originally or re-created with Eagle Point design packages. Using Eagle Point products, material quantities can be quickly derived from the design with the use of a quantity take off software that supports the design software package.

Onscreen Take-off

www.oncenter.com
Lois Rainey - District Sales Manager
1-800-880-8254 ext. 1025

On Center Software, Inc. has quoted a single unit price of $2,495.00 (August 2001). Other pricing options are available based on number of copies and method of purchasing.

DESCRIPTION

On-Screen Takeoff™, version 2.2—the software that gives you the bidding advantage in time and accuracy. On-Screen Takeoff allows you to perform complex take-offs right on your computer screen in a fraction of the time manual take-offs require.

For use with a digitizer and paper plans or a mouse and electronic plan files, On-Screen Takeoff enables the user to create live drawings with resizable conditions: linear conditions such as walls, pipes, and electrical lines; area conditions such as floors and ceilings; count conditions such as sprinkler heads, corner beads, doors, and windows; and zone conditions that assess quantities for any part of an area you specify. As you record conditions using your plans, the program provides reports on quantities and can recalculate instantly for any adjustment to the conditions of your project.

If you have been using an earlier version of OST, you will be delighted by the increased functionality of version 2.2. On-Screen Takeoff now provides support for CADD files, advanced condition features, and improved take-off screen layout, greater rendering performance, and highly improved Undo/Redo feature suitable for very large take-off projects.

New and experienced users will enjoy the power of this 32-bit estimating system that is amazingly easy to use. Moreover, like all products from On Center Software, this program works well for most construction trades and is ready to use the day you receive it. So, start bidding jobs more quickly and accurately today with On-Screen Takeoff.

Onscreen Take-off is designed for estimators and quantity surveyors seeking an easy to use take-off tool for paperless / electronic plans. Electronic plan files supported include tif, bmp, cal, osp, ost, pln, plt, pdf, dwg, dxf and others.

"Electronic plan distribution is on its way and Onscreen Take-off is the ideal tool for measuring items and recording the digitized drawings." Paper plan distribution is expensive and time consuming. With the increase in communication and computing technology, it is becoming more efficient, and less costly, to distribute drawing files electronically. Measuring quantities from paper plans often requires a costly digitizing tablet or a time consuming scale.

PRO

- Provides support for CADD & CAL files
- Faster, easier and more accurate take-offs.
- You can quantify lengths, areas, volumes, and perform counts right on your computer screen! While you work and the program will build your take-off list for you.
- Can be used with traditional paper plans using a digitizer or with electronic plans.
- The audit trail and checking the take-off, if it's colored, it's counted & color-coded drawings are easy to print and distribute.
- Determine Last minute plan changes are a snap!
- Create your own condition list and use it over and over again!
- Can create multi-layers and turn layers off & on as desired
- The non registered program can be used as a viewer
- Free training included!

CON

- Export is necessary. The Take-off measurements and counts can be exported to a spreadsheet.
- Requires you to create a take-off template in on-screen and a excel spreadsheet.
- Program is expensive.
- While On Center Software states that it provides support for CADD files in OnScreen Takeoff, it does not appear to be working, as it should, in this release. On Center has stated that version 2.3 will fix these problems.
- CADD file support requires strict attention to CADD file development and business practices.

SYNOPSIS

On-Screen has the versatility to create custom take-off templates and export them to an Excel spreadsheet. The creation of the templates & spreadsheets is very time consuming but once they are created, they can be used for many projects. The program allows you to have all project drawings available at one time. The user can scale and zoom in or out easily.

On-Screen meets the goal to enable cost engineers to work in the electronic drawing environment to identify material / quantity take-off portable to estimating software.

MaxTakeoff

8229 44th Ave. W, Suite G
Mukilteo, WA 98275

http://www.maxview.com/ Tel (425) 423-0777

MaxTakeoff quoted price at $490.00 (September 2001).

DESCRIPTION

MaxView offers software for viewing, printing, and performing on screen estimates. Their feature-rich package "MaxTakeoff" allows you to create, edit, move and delete annotations and mark-ups on electronic plans. An annotation is a note, a symbol, an image overlay, or a shape that's added to a page. Electronic plan formats supported include TIFF and CAL. With MaxTakeoff, persistent measurements and counts are retained from page to page and session-to-session. You can add multiple layers designating each one for a specific purpose and adding annotations to each. All annotations are tagged for easy recognition and summarization in the Information Window. The "Tool Driven" interface is easy to use and consistent with many other contemporary Windows applications.

After loading a drawing set, calibrating the drawing scale, creating the layer and annotation, quantity take-off can begin. By utilizing the measuring tools, you electronically measure and identify areas, lengths, and counts. This measurement/quantity information is automatically stored in an information window. From that window, you then copy the information to the clipboard and paste to a spreadsheet of your choice.

MaxTakeoff is relatively simple, efficient and no additional hardware is required.

PRO

- MaxTakeoff utilizes an easy to use "tool driven" interface which is highly configurable
- MaxTakeoff provides a clean audit trail of take-off information.
- It offers an easy to use layer manipulation that allows the user to name, color code, set symbology and toggle existing layers on/off.
- More than one document or several pages of the same document can be opened in separate windows simultaneously.
- The free MaxView viewer product "MaxReader" software allows you to preview the drawings and has scalable measuring tools and printing capabilities for drawing documents. You have the option to select and request an individual file or complete sets for downloading and viewing. This viewer software supports the US Army Corps of Engineers move to Electronic Bidding.
- A demo version of this software was available for review http://www.maxview.com/products/maxtakeoff.html.

CON

- This software requires an intermediate step to get your quantity information to a spreadsheet format.
- A spreadsheet such as Microsoft Excel is required to finalize the take-off information and enhance with a WBS system
- Does not work with electronic CADD files (dgn, dxf, dwg)

SYNOPSIS

MaxTakeoff provides a relatively easy to learn user-interface to provide the estimator with tools to develop take-off information. The takeoff quantity results can then be copied to a Microsoft Excel spreadsheet. One drawback is that it only allows for a single layer naming convention that requires the estimator to develop a more descriptive template design outside of the software environment, such as in Microsoft Excel. One unique characteristic of MaxTakeoff is the cursors action tools capability, which provides the user with a graphic cursor depiction of the current tool being utilized such as Measure Area, Measure Distance, Count Items, etc…

MaxTakeoff meets the goal to enable cost engineers to work in the electronic drawing environment to identify material / quantity take-off portable to estimating related software.

BidScreen XL

VERTIGRAPH, INC.
Construction Management Software

12959 Jupiter Road, Suite 252
Dallas, Texas 75238

www.vertigraph.com Tel (USA and Canada): (800) 989-4243

Vertigraph lists the price at $999.00 (August 2001).

DESCRIPTION

BidScreen XL is designed for estimators and quantity surveyors seeking an easy to use take-off tool for paperless, electronic plans while working in Microsoft Excel. Electronic plan files supported include tif, bmp, jpg, pic, dwg, dxf and others.

With BidScreen XL, you can zoom and pan the image while working in Excel. The drawing image can be full screen or reduced to allow viewing your working spreadsheet.

After loading a drawing and setting the drawing scale, quantity take-off begins from an Excel spreadsheet cell. With the tools, you can electronically measure and identify areas, lengths and counts from your electronic drawing files with your mouse. The measurements and digitized take-off drawings are saved with the Excel cell and can be edited and printed. Quantity take-off templates can be created for a variety of assemblies.

BidScreen XL is relatively simple, efficient and no additional hardware is needed. Microsoft Excel version 97 or later is necessary to operate the BidScreen XL Excel add-in.

As a new Vertigraph customer, the company literature indicates that six free months of Full_Serve is available from the customer support program. Full_Serve gives you access to all software enhancements (including downloads from the company Web site) and unlimited telephone support. After the initial six-month period, users can subscribe to Full_Serve for a nominal charge.

"Electronic plan distribution is on its way and BidScreen XL is the ideal tool for measuring items and recording the digitized drawings into a Microsoft Excel workbook. Paper plan distribution is expensive and time consuming. With the increase in communication and computing technology, it is becoming more efficient, and less costly, to distribute drawing files electronically. Measuring

quantities from paper plans often requires a costly digitizing tablet or a time consuming scale; with BidScreen XL you can now digitize with your mouse" states Erich Schoenkopf, President of Vertigraph, Inc.

Vertigraph Inc. provided a demonstration copy of BidScreen XL for evaluation. The following are observations and opinions of the evaluator.

PRO

- The audit trail and checking the take-off is done from each spreadsheet cell containing a take-off quantity. To verify the information in the spreadsheet cell is quick and straightforward. By executing the measure icon the drawing image appears to show current take-off items. Additional take-off can be added.

- No export is necessary. The Take-off measurements and counts are populated directly to the spreadsheet cell.

- Quantity take-off templates can be created for a variety of take-off applications and are only limited by the estimator's imagination and Excel capabilities.

- Each Excel spreadsheet cell is uniquely linked to the drawing take-off for that specific cell. In effect, each cell identifies its own take-off layer. Multiple drawing views can be open at the same time.

- BidScreen XL is relatively intuitive utilizing Windows operations. Training requirement is negligible. Unlimited telephone support for the first six (6) months is full service.

- Preset and custom scaling is included in the program.

CON

- Printing the image drawing for counting items appears to be determined by the software. Paper backup for counting items could be problematic with only black and white printers. The drawing may become much cluttered with take-off notations. Without color prints it appears that the only means of checking the counting take-off is electronically with the Excel spreadsheet and the loaded drawing.

- The zoom features must be manually turned off before measurements or counts can be activated.

- The drawing image can be full screen or reduced to allow viewing your working spreadsheet. However, you cannot navigate around the spreadsheet until the image view is closed.

- Colors, count symbols, line styles and area fill patterns can be added to the drawing image. The demonstration software provided for evaluation required continuous re-setting of the color and line styles for each measurement.

- BidScreen XL cannot view .cal images, which is the file format, used by the Corps of Engineers in distributing Electronic Bid Sets. Vertigraph has indicated they are currently working on the ability to view .cal files.

- A non-proprietary image viewer is not available with this software.

- CADD file support requires strict attention to CADD file development and business practices.

SYNOPSIS

The versatility to create custom take-off templates in Excel and directly quantify the cell using BidScreen XL is the most desirable feature of this Excel Add-in. Having to continually reset the style for each particular measurement is a minor annoyance. Having to turn on and turn off zoom features is also time consuming.

BidScreen XL meets the goal to enable cost engineers to work in the electronic drawing environment to identify material / quantity take-off portable to estimating software.

Estimators currently using Excel Spreadsheet for tabulating drawing take-off may find this Add-in an asset to their needs.

4. – Analysis

The analysis is a value engineering process. The first part is analysis and weighting of evaluation criteria and the second part is software analysis that evaluates how well each software meets each criterion. The result is a ranking of software.

Evaluation Criteria

The CFAC group met to develop and define evaluation criterion. Each criterion was weighed according to all other criteria using a Value Engineering process.

A – Does the program maintain a clear and reproducible Audit Trail? Does the program maintain information for an independent take-off check or provide for redlining for design changes? Does the program have a way to create a backup, maintain links between drawing and take-off information, and ability to change symbols and take-off notations?

B – Can the take-off program export to common database and spreadsheet programs in the windows environment? Are there intermediate exporting steps or can the take-off program populate databases and spreadsheets directly?

C – Initial program cost. Are site licenses and or individual stand alone licenses available.

D – How versatile is the take-off program. Are work breakdown structures fixed or open and modifiable? Does the program allow for a range of template capability?

E – Are viewing layers and take-off levels possible?

F – How would the program rank in terms of ease of use or how user friendly is the take-off program? Can the program show multiple views? Is there ability to capture or annotate quantities in the third dimension (3D), i.e. vertical drops or returns into the paper?

G – Is training provided and how difficult may it be to learn the software?

H – Can the program read vector format drawings on screen and allow for scaling directly from the drawing?

I – Can the program read tiff format drawings on screen and allow for scaling directly from the drawing?

J – Is the software open and not proprietary? Is it open to use third party data and what are the possibilities for immediate modification for Corps of Engineers' applications? Is there a free drawing viewer module?

Table 1, Criteria Weighing, shows criteria weighing and weighted value for each criterion. This is accomplished by the following.

- First, compare criteria A against criteria B,
- Which criteria is more important, A or B (enter the appropriate letter into the table,
- The two criteria differ by a value from 0 to 5 (enter that value into the table),

  PREFERENCE WEIGHING
  0 - No Difference between criteria
  1 - Minor Difference between criteria
  2 -
  3 - Medium Difference between criteria
  4 -
  5 - Major Difference between criteria
- Continue comparing each criterion to the remaining criteria determining which criteria is more important and the value by which they differ.
- Criteria weighing (Score) is the summation of values for each criteria.

Table 1, Criteria Weighing

CRITERIA:

A - **Audit Trail - Ability to check, Redline, Layer on/off, backup, cross section, capture link, symbology**
B - **Export to Database, Excel, Lotus - and intermediate steps**
C - **Cost (Initial Cost) Site license versus Individual**
D - **WBS, fixed, open, template capability**
E - **Layers - viewing levels take-off**
F - **Ease of use - multiple views - user friendly - capture vertical drops**
G - **Training - difficulty of the software to learn**
H - **Read Vector format – allow for scaling**
I - **Read Tiff format - allow for scaling**
J - **Open not proprietary – free viewer, open to 3rd party, immediate modification**

	B	C	D	E	F	G	H	I	J		SCORE	ORDER
	A	A	A	A	A	A	A	A	A		A's	
A	0	4	2	1	2	3	1	0	2		15	
		B	B	B	B	B	B	B	B		B's	
	B	4	2	1	3	3	1	0	2		16	
			D	E	F	C	H	I	J		C's	
		C	4	3	3	0	3	4	4		0	LOW
				E	F	D	H	I	D		D's	
			D	1	1	2	2	3	1		7	
					E	E	H	I	E		E's	
				E	1	1	2	3	2		8	
						F	H	I	F		F's	
					F		2	3	2		6	
							H	I	J		G's	
						G	2	3	2		0	LOW
								H	H		H's	
							H		3		15	
									I		I's	
								I	4		20	HIGH
											J's	
									J		6	

Software Analysis

The second phase of the overall analysis is represented in Table 2, Analysis Matrix. This analysis matrix is completed by determining how each software meets each individual criterion. Numbers ranging from five (5, excellent) to one (1, poor) are used to describe each program as it relates to each of the criterion. Half numbers are used to enhance this particular analysis. The selected number is entered in the appropriate block and that number is multiplied times the weight value of the appropriate criterion. The result is the weighted score for that criterion. After completing this process for each software, the summation of weighted scores is entered in the total column to the right. The highest total indicates the software having the greatest preference. This would normally be the recommended product or alternative.

Table 2, Analysis Matrix

A - **Audit Trail - Ability to check, Redline, Layer on/off, backup, cross section, capture link, symbology**

B - **Export to Database, Excel, Lotus - and intermediate steps**

D - **WBS, fixed, open, template capability**

E - **Layers – viewing levels take-off**

F - **Ease of use – multiple views - user friendly - capture vertical drops**

H - **Read Vector format - allow for scaling**

I - **Read Tiff format – allow for scaling**

J - **Open not proprietary - free viewer, open to 3rd party, immediate modification**

	A	B		D	E	F		H	I	J	
Weight From Criteria Matrix:	15	16		7	8	6		15	20	6	
	On Center Software										**Totals**
1	"On-Screen Takeoff"	*4.5*	*3.0*		*3.0*	*4.5*	*4.5*		*4.0*	*4.5*	*4.0*	
	Weighted Score:	67.5	48		21	36	27		60	90	24	373.5
	Vertigraph, Inc.										
2	"BidScreen XL"	*3.0*	*4.5*		*4.0*	*2.0*	*3.0*		*4.5*	*2.0*	*1.5*	
	Weighted Score:	45	72		28	16	18		67.5	40	9	295.5
	Eagle Point Software, Inc.										
3	Quantity Take-off	*2.5*	*3.5*		*2.5*	*1.5*	*2.0*		*4.0*	*1.5*	*1.5*	
	Weighted Score:	37.5	56		17.5	12	12		60	30	9	234.0
	MaxView Corporation										
4	MaxTakeoff	*3.5*	*2.5*		*1.5*	*3.0*	*2.5*		*1.0*	*4.0*	*2.0*	
	Weighted Score:	52.5	40		10.5	24	15		15	80	12	249.0
	Agtek *										
5	Takeoff	*3.0*	*2.0*		*2.0*	*1.0*	*2.0*		*3.5*	*1.0*	*1.0*	
	Weighted Score:	45.0	32.0		14.0	8.0	12.0		52.5	20.0	6.0	189.5
	Bentley Systems										
6	Power Scope	*2.0*	*1.0*		*1.0*	*1.0*	*1.0*		*4.5*	*1.5*	*1.0*	
	Weighted Score:	30.0	16.0		7.0	8.0	6.0		67.5	30.0	6.0	170.5

* A demonstration program was not available for evaluation. The evaluation is based only upon interviews and product literature.

5 – Conclusions and Recommendations

General

The Cost Engineering function within the Corps of Engineers must recognize that as we progress from stand alone estimating to estimating utilizing electronic CADD products, the Cost Engineer must become familiar with and be able to work within the CADD environment.

Dual monitors and associated hardware may be desirable for complex project quantity take-off.

Consistency and uniformity throughout the Cost Engineering function in using MCACES estimating software is directed by regulation ER 1110-2-1302, Civil Works Cost Engineering. Made possible through utilization of the Tri-Service Automated Cost Engineering System (TRACES), uniformity and consistency enables the Corps of Engineers to assemble effective virtual project delivery teams comprised of cost estimators from several districts across the nation.

There is a strong desire to maintain similar consistency throughout the Corps in regards to quantity take-off. However, Quantity take-off is not a part of upward reporting, nor is the process, nor particular software for quantity take-off identified in regulations. Because Districts conduct civil work, military work, and hazardous – toxic – radioactive waste (HTRW) work, quantity take-off for each can be drastically different. Estimate templates vary and the bulk of take-off items vary.

Conclusions

Total scores from the criteria weighting, Table 1, show that functionality criteria are weighted more than cost and training criteria. This is not to say that cost and training efforts are not important, but the evaluation is to identify the most functional software for quantity take-off.

Software evaluated by the matrix analysis, Table 2, meet the basic requirements for quantity take-off using electronic plans displayed on a monitor. How well each software meets the evaluation criteria is reflected by the total weighted score from Table 2.

Evaluating products against specific criteria can be very subjective. However, applying a value engineering process, with team consensus throughout, results in the quantitative evaluation of each program against the criteria.

RANKING	DESCRIPTION	TOTAL WEIGHTED SCORE
1	On-Screen Takeoff, OnCenter Software Inc.	373.5

2	BidScreen XL, Vertigraph Inc.	295.5
3	MaxTakeoff, MaxView Corporation	249.0
4	Quantity Take-off Modules, Eagle Point Software	234.0
5	Takeoff, Agtek	189.5
6	Power Scope, Bentley Systems	170.5

Recommendation

Based on evaluations and analysis of this report, the three top ranked quantity take-off software products are recommended. Each meet the goal to enable cost engineers to work in the electronic drawing environment to identify material / quantity take-off portable to estimating software. Each software has the ability to populate or export to a spreadsheet format. Spreadsheet calculations appear to be the most likely and most widely used format prior to inserting quantity data into estimating programs.

On-screen Takeoff has the versatility to create custom take-off templates and provides for export to a spreadsheet. The creation of the templates & spreadsheets is very time consuming but once they are created, they can be used for many projects. The program allows you to have all project drawing available at one time. Manipulating the drawing on-screen for scale and zoom in or out is easily accomplished.

BidScreen XL is an Excel add-in. The versatility to create custom take-off templates in Excel and directly quantify the cell using BidScreen XL is the most desirable feature of this Excel Add-in. Having to continually reset the style for each particular measurement is a minor annoyance. Having to turn on and turn off zoom features is also time consuming. Estimators currently using Excel Spreadsheet for tabulating drawing take-off may find this Add-in an asset to their needs.

MaxTakeoff provides a relatively easy to learn user-interface. Takeoff quantity results can be copied to a Microsoft Excel spreadsheet. One drawback is that descriptive templates must be created outside of the software environment. One unique characteristic is a graphic cursor depiction of the current tool being utilized.

Cost Estimating offices currently without a defined quantity take-off system should consider On-Screen Takeoff or MaxTakeoff as a tool to implement electronic drawing take-off.

Cost Engineering offices or individual estimators that already use extensive Excel spreadsheets for quantity take-off may find BidScreen XL the most applicable to their existing take-off processes.